

I claim:

1. A contact lens having a physical design parameter determined by an objective wavefront measurement of a plurality of *in-situ* trial contact lenses each having a different value of the physical design parameter for a given correcting power.
2. The contact lens of claim 1, wherein the contact lens is one of a soft monofocal lens, a soft multifocal lens, an RGP monofocal lens, an RGP multifocal lens, a toric lens, a simultaneous style presbyopia correcting lens, an alternating vision style presbyopia correcting lens, and a diffractive lens.
3. The contact lens of claim 1, wherein one of a PSF and a Strehl ratio are used to determine an improved *in-situ* optical performance is by the lens.
4. The contact lens of claim 1, wherein the design parameter is at least one of the shape of the posterior lens surface, the shape of the anterior lens surface, and the asphericity of the anterior lens surface.
5. A method for designing a contact lens, comprising:
 - a) determining an objective measurement criteria of optical performance of a contact lens *in-situ*;
 - b) determining a technique for measuring this criteria;
 - c) determining a lens design parameter that can be varied to induce a change in the optical performance of the lens *in-situ*;
 - d) measuring the *in-situ* optical performance of a test lens over a range of different design parameter values; and;
 - e) selecting the design parameter value for designing a contact lens that gives a desired *in-situ* optical performance measurement.

6. The method of claim 5, wherein determining the objective, *in-situ* optical performance further comprises determining a retinal image metric including at least one of the PSF and the Strehl ratio.
7. The method of claim 5, comprising using a wavefront sensor for measuring the optical performance criteria.
8. The method of claim 5, wherein determining the lens design parameters further comprises determining at least one of the shape of the posterior lens surface, the shape of the anterior lens surface, and the asphericity of the anterior lens surface.
9. The method of claim 5, wherein determining the lens design parameters further comprises determining an optical design parameter including the higher-order aberration content of the lens.
10. The method of claim 9, comprising determining an amount of spherical aberration of the lens.
11. The method of claim 5, wherein the lens design parameter is a lens factor that induces a higher-order aberration in the patient's eye.
12. The method of claim 5, wherein measuring the *in-situ* optical performance of a test lens involves making test lens measurements on a statistically significant population group.
13. A method for designing a contact lens, comprising:
 - a) selecting a plurality of trial contact lenses each of which has a substantially similar refracting power and a different, respective, design parameter;
 - b) obtaining a real-time wavefront measurement of the *in-situ* optical performance of each trial contact lens;

- c) monitoring the different design parameter values of the lenses in conjunction with each optical performance measurement;
- d) using the measure of the *in-situ* optical performance of the lens design to determine a preferred design parameter value; and
- e) designing a contact lens based upon the preferred design parameter value.

14. The method of claim 13, wherein obtaining a real-time wavefront measurement comprises measuring each lens on a statistically significant population group.

15. The method of claim 13, wherein obtaining a real-time wavefront measurement of the *in-situ* optical performance further comprises determining a retinal image metric including at least one of the PSF and the Strehl ratio.

16. The method of claim 13, wherein selecting different, respective, design parameters includes selecting at least one of the shape of the posterior lens surface, the shape of the anterior lens surface, and the asphericity of the anterior lens surface.

17. An improved method for prescribing a contact lens, comprising using a plurality of real-time wavefront measurements of the *in-situ* optical performance of a respective plurality of trial contact lenses as a function of a physical design parameter to determine the best *in-situ* optical performance for a statistically significant sample of subjects.

18. An improved method for prescribing a contact lens, comprising:

- a) providing a plurality of trial lenses each of which provides a desired correction for sphere and cylinder, wherein each of the trial lenses has a different, respective, design parameter;
- b) consecutively providing each trial lens to a subject *in-situ*;
- c) obtaining a real-time wavefront measurement of the *in-situ* optical performance of each lens; and

- d) prescribing a contact lens for the subject in accord with the best measured optical performance of the trial lenses.
19. An improved method for providing a contact lens, comprising:
- a) obtaining a refraction measurement of a subject's eye;
 - b) selecting a plurality of trial contact lenses each of which have a similar refractive correction power and a different, respective, design parameter;
 - c) applying a first one of the trial contact lenses on the subject's eye;
 - d) obtaining a wavefront measurement of the *in-situ* optical performance of the first one trial contact lens;
 - e) removing said trial contact lens and applying a different, next one of the trial contact lenses on the subject's eye;
 - f) obtaining a wavefront measurement of the *in-situ* optical performance of the next trial contact lens;
 - g) repeating steps (e) and (f) for a desired number of trial lenses; and
 - h) providing a contact lens similar to the trial lens that provides the optimum optical performance *in-situ*.
20. The method of claim 19, wherein the design parameter is at least one of the shape of the posterior lens surface, the shape of the anterior lens surface, and the asphericity of the anterior lens surface.
21. The method of claim 19, wherein the design parameter is a higher-order aberration content of the lens.
22. The method of claim 21, wherein the design parameter is the amount of spherical aberration of the lens.

23. The method of claim 19, wherein the design parameter is a lens factor that induces a higher-order aberration in the patient's eye.
24. The method of claim 22, wherein the lens factor induces an amount of spherical aberration in the patient's eye.
25. The method of claim 19, wherein the prescribed contact lens is one of a soft monofocal lens, a soft multifocal lens, an RGP monofocal lens, an RGP multifocal lens, and a toric lens.
26. A method for using an aberrometer for designing and/or prescribing a contact lens, comprising:
- making a wavefront measurement of a subject's eye with a first *in-situ* trial lens having a known design parameter value that affects optical performance;
 - making a next wavefront measurement of a subject's eye with a next *in-situ* trial lens having a different valued, respective, known design parameter that affects optical performance;
 - determining an objective optical performance metric of each trial lens based upon the respective wavefront measurement; and
 - designing and/or prescribing a contact lens based upon the design parameter of the trial lens that provided the optimum optical performance metric.
27. The method of claim 26, wherein making a wavefront measurement further comprises determining a retinal image metric including at least one of the PSF and the Strehl ratio.
28. The method of claim 26, wherein the known lens design parameters comprise at least one of the shape of the posterior lens surface, the shape of the anterior lens surface, and the asphericity of the anterior lens surface.

29. The method of claim 26, comprising using a Shack-Hartmann aberrometer to make the wavefront measurements.

30. A method for designing a contact lens, comprising the steps of:

a) providing a simultaneous style multi-focal trial contact lens to a patient having astigmatic presbyopia such that the trial lens provides a subjectively determined satisfactory visual quality for near-vision and far-vision defocus without an astigmatic correction;

b) measuring a wavefront aberration of the in-situ placement of the trial lens and determining an objective vision quality metric corresponding to the subjectively determined visual quality; and

c) changing a design parameter of the trial lens to reduce the astigmatism aberration and so changing a spherical aberration of the wavefront measurement until a value of an associated objective vision quality metric becomes substantially the same as the determined objective vision quality metric.

31. The method of claim 30, wherein determining an objective vision quality metric includes determining an image plane metric comprising at least one of a PSF, an MTF, a Strehl ratio, a neural contrast sensitivity function, a contrast sensitivity function, a variance of a PSF, an entropy of a PSF, and an encircled energy within an Airy disk of a PSF.

32. The method of claim 30, wherein changing a design parameter of the trial lens to reduce the astigmatism includes changing an anterior surface shape of the trial lens to produce a toric asphericity on the surface.

33. The method of claim 30, wherein changing a design parameter of the trial lens to reduce the astigmatism aberration comprises monitoring the wavefront aberrations and reducing a Zernike coefficient associated with the astigmatism.

34. The method of claim 30, wherein step (c) involves a simulated change using an aberrometer measurement and associated aberration and image quality metric calculations provided by the aberrometer.